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A study on physico chemical characteristics of gopaldinne reservoir, wanaparthy, Telanagana

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Abstract
Physico chemical parameters such as Atmospheric temperature, water temperature, pH, total dissolved solids, dissolved Oxygen, free carbon dioxide, total alkalinity, chlorides, phosphate, total hardness and biological oxygen demand were analyzed for Gopaldinne reservoir located at Wanaparthy, Telangana during 2023. all the physical and chemical parameters were observed to be within the permissible limits of various standard methods of APHA and BIS etc. This indicated the selected lake is none polluted a since it is free from sewage, industrial effluents.

Keywords: Water, physico-chemical parameters, phytoplankton, lake, Gopaldinne

Introduction
Water, the most crucial renewable natural resource, covers more than 70% of the earth's surface. It is the basis of all living organisms. Freshwater today is a scarce resource. More than 2000 million people will live under conditions of high water stress by the year 2050. Meanwhile, 1.8 billion people are predicted to live in regions with absolute water scarcity by 2025. Management, exploitation of water in catchment and command areas has led to severe water quality impairment. Inland water bodies are subjected eutrophication as they are receive to sewage discharge, agricultural practices and urban run offs and disrupt aquatic ecosystems. Water contamination has been an emerging issue. Water quality, is influenced by anthropogenic activities [1]. Further, regular changes in surface water and ground water quality must be considered as poisons [2]. Water scarcity is, therefore, thought to be a serious problem throughout the world and mitigating this problem is one of the biggest challenges of the 21st century. India's population is projected to stabilize around 1640 million by 2050, leading to a significant decline in per capita water availability. Water is a renewable natural resource that plays a vital role in the survival of living organisms [3]. It is one of nature's most abundantly available substances, covering more than 70% of the earth's surface. Good quality water is required for living organisms. At the same time, growing populations, progressive industrialization, and intensification of agriculture have led to increased pollution of water resources [4].

A lake is a sizable water body surrounded by land and fed by rivers, springs, or local precipitation. A lake's structure significantly impacts its biological, chemical, and physical features. Lakes can be classified based on a variety of features, including their formation and their chemical or biological condition, as oligotrophic and eutrophic [5]. Phytoplankton, being dominant photoautotrophic organisms in the aquatic environment, plays a significant role as a tool in assessing the quality of the water [6]. This was because of the high degree of sensitivity these organisms exhibit to the altering environment. The degree of contamination with the other substances corresponds to definite micro flora and microfauna. Thus, there was a possibility to establish the severity and type of pollution by the presence of indicator organisms in a given habitat. The seasonal change governed the phytoplankton's distribution and periodicity [7]. In general, biological parameters involve the study of biotic diversity, and the productivity of flora and fauna in relation to the physicochemical environment prevailing in a specific habitat.

Materials and Methods

Sample collection site

Gopaldinne reservoir is located in between 16.°7'51"N 78.°6'6"E. The Present study aims to monitor the quality of lake water so as to assess the water quality of the lake.

Collection of water samples

The water samples from the surface were collected from the two sampling stations every month in polythene cans for a period of 1 year from January 2023 to February 2022. Water samples were collected in separate 250 ml glass bottles (BOD bottles) for the estimation of dissolved oxygen. All the samples were carried to the laboratory. The samples were analyzed on the same day for different physico-chemical factors following the standard methods. The factors analyzed in the present study include Temperature, pH, Carbonates, Bicarbonates, Chloride, Dissolved Oxygen, Biological Oxygen Demand, Chemical Oxygen Demand, Phosphates, Sulphates, Nitrates, Total Solids, total alkalinity, Total hardness [8].

Results and Discussion

Various physicochemical parameters were analyzed from two stations from the study site i,e Gopaldinne reservoir, and the results were presented in Table 1 and 2. During the present investigation the atmospheric temperature in summer fluctuated between 28.6–25.4˚C and 26.8–24.3˚C; 28.8and 25.3 ˚C at station I and II respectively. The highest atmospheric temperature was recorded in the month of May and the lowest in the month of February at both the stations. Temperature exhibits impact on biological activities and growth. To a certain point, the increase in temperature leads to greater biological productivity, above and below which it falls, and it also governs the kind of organisms (species composition). At elevated temperatures, the metabolic rate of organisms increases, requiring more oxygen. On the other hand, solubility of oxygen decreases. Temperature affects DO, solubility, density, pH, conductivity, etc. Water holds less oxygen at higher temperatures [9]. At elevated temperatures, some compounds are more toxic to aquatic organisms. Additionally, the temperature of drinking water has an influence on its taste. P^H is hydrogen ion concentration, and it is used to measure and express the intensity of acidity or alkalinity. Any change in the pH of water is coupled to other physico-chemical aspects of the medium. The pH of water influences the solubility and biological availability of chemical nutrients like phosphorus, nitrogen, carbon, and heavy metals like lead, copper, cadmium, etc. pH determines how much and what form of phosphorus was most abundant in water [10].

During the present investigation, the pH values varied between 7.3 and 7.8 at station I and 7.79 at station II. During the same season, both stations recorded the highest pH value in May and the lowest in September. During the present investigation, total dissolved solids values vary between 280–176 mg/l in station I and 324–197 mg/l at station II. It was more during summer and minimum in the post monsoon season. The dissolved Oxygen values varied between 8.53 and 9.0 mg/l in station I and 8.8–9.5 mg/l in station II. It was maximum during summer and minimum in the monsoon season. The Free carbon dioxide values vary between 5.4 and 5.1mg/l in stations I and II. The total alkalinity values varied between 238 and 237 mg/l at station I and station II, and the chloride values varied between 75–74.2 mg/l at station I and station II. The phosphate values varied between 1.4 and 1.078 g/l I and 0.9–1.1 mg/l at station II. The total hardness values were 189 and 184 mg/l, and the BOD values varied between 4.2 and 4.3 mg/l at stations I and II.

Carbonates exhibited a positive relationship with pH, with dissolved oxygen, and an inverse relationship was observed with chlorides. Dissolved oxygen influences the aquatic environment chemically and biologically. Dissolved oxygen affects nutrient availability, resulting in the productivity change in water body. Dissolved oxygen is more during winter season due to the higher algal population and increased magnitude of photosynthesis at lower temperatures. The oxygen demand is proportional to the quantum of organic waste to be degraded aerobically [11]. Hence, BOD approximates the amount of oxidisable organic matter in the solution, and its value can be employed to measure waste amount.

The total hardness of water was a complex mixture of cations and anions. It was predominantly due to significant cations like calcium and magnesium. The effect of these major cations on the growth of flora was of ecological significance. Magnesium is correlated with total hardness. The high values were observed in summer, possibly due to evaporation, increasing the magnesium concentration. Rocks, fertilizers, and waste discharges are the sources of sulfur, even industrial effluents from paper industries are the sources of sulfates. Apart from small quantities of phosphates present in a lentic system, cleaning detergents, etc., form the primary sources of phosphates.

Nitrates were observed in traces during the major part of the investigation at the lake but exhibited high values at the onset of rain. The nitrates are a measure of eutrophication, as it determined the content and availability of decomposable organic matter. Total solids in natural water refer to suspended and dissolved material. It could be due to washing clothes and other contaminants due to bathing animals and humans, which was usually at a higher proportion. The values of Total dissolved solids were more in summer. Maximum monsoon values in the lake could be attributed to the increased surface runoff, resulting in an increased level of allochthonous organic matter, resulting in dissolved solid content.

Magnesium is correlated with chlorides; total suspended solids showed a positive relationship with chlorides. Total hardness is inversely correlated with carbonates. Sulfates and phosphates showed a positive correlation with chlorides, and Nitrates showed a positive correlation with carbonates, and calcium and negatively correlated with total dissolved solids.

Total solids are in inverse relationship with DO and organic matter and positively correlated with carbonates and BOD. Sulfates are negatively correlated with carbonates and DO. Nitrites positively correlate with total hardness and calcium and negatively correlated with magnesium and total dissolved solids. Nitrates exhibit a positive correlation with calcium and DO and are negatively correlated with carbonates total, dissolved solids. Calcium is directly correlated with pH, chlorides, and total suspended solids, and positively correlated with organic matter. Nitrates exhibit a negative correlation with total dissolved solids.

Table 1: Study site I

Month	AT (ºC)	WT (ºC)	PH	NO_3 (mg/lit)	TDS (mg/lit)	DO (mg/lit)	CO_3^{2-} (mg/lit)	TA (mg/lit)	CL (mg/lit)	P (mg/lit)	TH (mg/lit)	BOD (mg/lit)
23-Feb	26.8	24.3	7.2	41	210	6.8	3.2	238	45.1	1.3	141	4.1
23-Mar	26.9	24.1	7.4	42	200	6.9	4.3	204	49.9	0.89	144	3.8
23-Apr	28.5	25.2	7.5	40	187	7.1	Ab	201	62.2	0.70	174	3.6
23-May	28.6	25.4	7.6	40	289	7.5	2.5	199	74.2	1.4	187	4.2
23-Jun	26.2	22.5	7.5	39	207	7.6	Ab	187	75.2	0.87	189	3.4
23-Jul	25.3	22.6	7.6	38	244	7.8	Ab	168	69.2	0.94	180	3.1
23-Aug	24.6	22.0	7.3	36	178	7.1	Ab	154	61.1	0.64	169	3.4
23-Sep	24.3	22.1	6.6	37	184	7.1	Ab	102	59.0	0.84	165	3.5
23-Oct	22.5	21.0	7.2	39	287	7.2	3.9	108	47.4	0.86	145	3.4
23-Nov	21.3	20.3	7.4	40	286	7.4	4.7	129	46.4	0.89	139	3.5
23-Dec	19.8	19.5	7.3	41	274	6.1	4.4	132	61.2	0.78	119	3.6
20-Jan	20.2	19.2	7.1	42	271	6.2	5.1	165	48.6	0.88	105	4.0

Table 2: Study site II

Month	AT (ºC)	WT (ºC)	PH	NO_3 (mg/lit)	TDS (mg/lit)	DO (mg/lit)	CO_3^{2-} (mg/lit)	TA (mg/lit)	Cl (mg/lit)	P (mg/lit)	TH (mg/lit)	BOD (mg/lit)
23-Feb	26.4	25.3	7.4	42	215	6.4	3.8	237	45.7	1.1	144	4.3
23-Mar	26.4	25.1	7.5	44	207	6.7	4.4	241	46.9	0.81	141	3.9
23-Apr	27.1	26.2	7.7	41	198	7.4	Ab	234	63.2	0.71	171	3.1
23-May	28.8	26.4	7.9	43	325	7.1	2.6	214	74.2	1.78	183	4.4
23-Jun	26.1	24.5	7.8	42	209	7.4	Ab	197	71.2	0.91	184	3.7
23-Jul	25.9	24.6	7.8	39	247	7.1	Ab	187	68.2	0.91	182	3.8
23-Aug	24.3	22.0	7.8	40	198	7.4	Ab	154	67.1	0.74	171	3.3
23-Sep	24.7	23.1	6.7	39	257	7.3	Ab	109	62.0	0.84	174	3.6
23-Oct	22.9	20.4	7.3	41	292	7.5	3.4	110	57.4	0.81	154	3.3
23-Nov	21.7	20.2	7.9	44	284	7.3	4.2	134	56.4	0.82	157	3.4
23-Dec	20.1	19.1	7.1	42	297	6.8	4.4	157	63.2	0.74	124	3.4
20-Jan	20.4	19.1	7.4	44	289	6.7	5.9	172	49.6	0.81	131	4.2

Summary

The physic-chemical characteristics exhibited interrelationships. The pH and carbonates are directly correlated. The pH and carbonates are inversely proportional to bicarbonates. Chlorides showed an inverse correlation with carbonates. Dissolved oxygen shows an inverse correlation with organic matter and biological oxygen demand. Total hardness is negatively correlated with carbonates. Sulfates and phosphates showed a positive correlation with chlorides. Nitrates showed a positive correlation with carbonates, bicarbonates, and calcium and were negatively correlated with total dissolved solids. The biological parameters include estimating phytoplankton community structure and distribution in various seasons. Temperature, organic matter, phosphates, and nitrates influence the growth of Algae. Hence, the lake was non-polluted based on both physicochemical and biological parameters. According to drinking water standards of BIS, BOD should be lower than 6 mg/L and in the present study it was found in an optimum level and the water is fit for drinking.

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